# Gas Journal

VOL. 295. 110th YEAR. LONDON, AUGUST 6, 1958. No 4960. PRICE 1/6



AUG 1 1958

ENGINEERING

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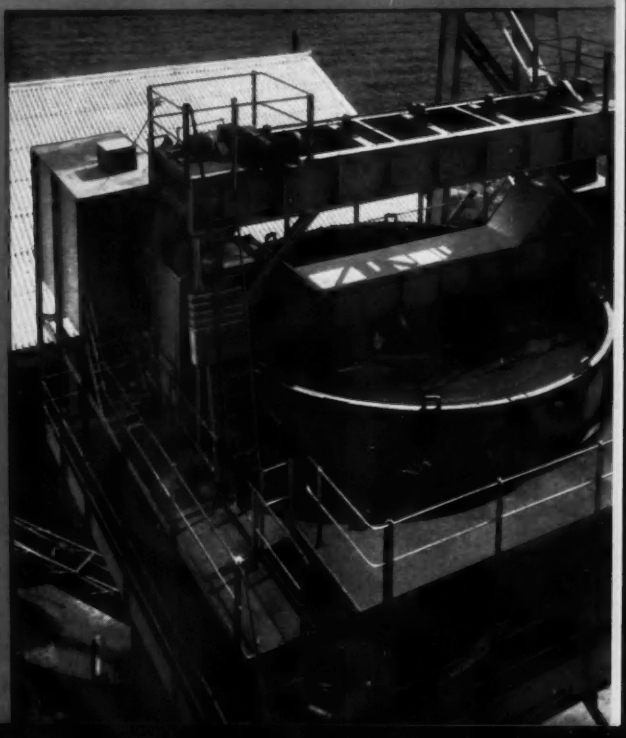

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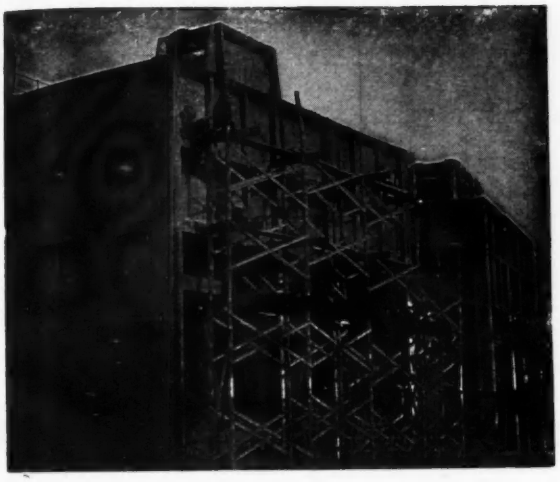

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*Handbook "GUNITE" sent on request*

# Gas Journal

VOL. 295 NO. 4960 6 AUGUST, 1958

110TH YEAR

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**There is more in gas metering than meets the eye**

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6, 1958

Gas Journal

VOLUME 295. No. 4960 AUGUST 6, 1958. 110th YEAR

# *The Federation Fights Back*

WHEN, in our issue of January 8, we speculated on the usefulness and potential of the Women's Gas Federation, it was in the hope that it might make both the Federation and the gas boards stop and think. Having deplored the interpretation (particularly if in some cases justified) of the Federation as 'a collection of middle-aged, semi-professional bun fight devotees who use gas as a slender excuse for indulging in an orgy of tea-drinking and gossip,' and stressed the need to enlist younger members, we ventured to make a few suggestions. We urged gas boards to make certain that the members of their branches were fully conversant with what the industry has to offer, and that they sent their sales officers to talk to the branches regularly; moreover, we suggested that branch chairmen be encouraged to attend gas board functions, to take an interest in the activities of gas consultative councils and be present at the launching of new appliances. Finally, we listed various ways in which the Women's Gas Federation could help the industry: By serving as a sounding board for opinions on all matters concerned with gas appliances and gas board service; by functioning as a form of field test for certain new equipment; by enabling the advantages of gas and the gas industry's viewpoint (including the Annual Reports) to be made known through the multitude of social and business contacts enjoyed by members; and by acting as a substantial and respected body of opinion able to approach the Government and local authorities in a manner denied the Gas Council and the area gas boards.

It is much to the credit of the Federation that far from taking all this lying down, they promptly sent reprints of the editorial to their 142 branches and asked for comments and suggestions for ways in which branches could do more. The replies, of which we have seen a summary, were most interesting. For example, commenting on their liaison with the industry, one or two reported that there was a lack of interest in the branch by the local manager, while several mentioned that close co-operation with the district manager was essential. A number of branches thought the Federation could and should be used more than it is by the industry, and it was pointed out that branches were very willing to accept advice from industry on publicising gas. Practically all spoke of their appreciation of the help given by home service advisers.

When we came to the branches' own suggestions for improving their service to the industry the replies were even better. Among the ideas put forward were five-minute 'flashes' on new appliances at each meeting, more area conferences, representation on gas consultative committees and councils (several branches had invited the chairmen of their councils to speak to their members), open meetings arranged by the branches to which members of other organisations and the general public are invited, and the need for branches on new housing estates. It was further suggested that branches should receive civic recognition by inviting the Mayoress to become president, and by registering the branch and names of officers, etc., at the town hall; it was thought that branches should ensure that their membership represented a good cross-section of the community. It is important to note that the need was felt for talks on the industry to be more interesting to the housewife—some branches said that such talks were too technical and therefore boring to the members. The majority of branches expressed a desire to help the industry, and said they would welcome suggestions for ways of doing this. Several branches stressed the value of demonstrations by the home service advisers.

Surely this response suggests that it is now up to the industry to capitalise on the Federation's responsiveness and to see that neither neglect nor mishandling spoil its relations with what could and should be a valuable body of voluntary public relations officers. On the other hand, if boards do not agree that the ideas put forward are sound and cannot see their way clear to improve their relations with the branches in their area, they

would be well advised to remove their support entirely since in those circumstances the W.G.F. in their area would indeed be as useless as its sternest critics have suggested. It is a case of all or nothing at all—if boards cannot put a little thought into stimulating local branches and take a little trouble in nursing them along, then for goodness sake let them leave them alone. Far better to have no branch at all than one which is half dead for want of support.

## *Report on Co-operation*

THAT despite neglect from certain quarters the Federation is very much alive is demonstrated by the memorandum which it has prepared for the committee on co-operation between area and Scottish gas and electricity boards. This document, representing the views of about 63% of its 16,000 members, is an excellent example of the part which the Federation can play in fuel affairs. Although the W.G.F. is allied to the gas industry by virtue of its constitution, it has greater freedom to express its views and is not compelled to toe the party line. That being so, the views it has expressed on this matter are significant. The following is a summary of the observations made.

On the subject of meter reading and billing exactly half the branches which replied were in favour of separate reading and billing as at present because, they said, it is easier on household budgets to pay accounts at different times, because the meter reader provides a valuable link with the industry concerned, because of the administrative and physical difficulties involved in joint reading and billing, and because apart from trade union difficulties and possible redundancy of personnel, no great saving is envisaged due to automation in dealing with accounts. Of the remainder, the majority were in favour of joint reading and billing on grounds of economy and convenience, and the rest thought joint meter reading was desirable but not practicable. However, it was suggested that boards might give a discount on promptly paid bills, and thought there was a possibility of meter reading and billing being divorced from both industries, and being dealt with by a separate organisation.

The vast majority of branches were in favour of retaining separate service centres and showrooms, but it was suggested that the practice of using mobile display vans instead of showrooms in rural areas might be extended and the possibility of separate departments under one roof in small country towns where separate showrooms often appear to be not fully utilised, might be explored.

Comments on advertising were particularly interesting in that, after all, members are on the receiving end and might even have gone so far as to consider themselves the victims of the advertisers. In fact their viewpoint was much more enlightened. The majority of branches thought advertising was healthy and essential for the promotion of business, and one branch went so far as to state that it was the only medium through which the consumer could be kept informed. On the other hand, some branches felt that too much money was spent on advertising and that advertising should be the responsibility of the manufacturers and not the industry. Nevertheless, the concensus of opinion was that while competition is a matter of Government policy, advertising is essential to efficiency. The Federation considers that in the past advertising has stimulated the industries and the manufacturers in developing design and service to the public, and that it is an essential medium for making known to the consumer the full range of services which the industries are in a position to render. In particular, it is pointed out that since so many gas consumers use pre-payment meters, and many others send cheques by post for the payment of their accounts, visits to showrooms by many consumers are very rare.

On the subject of co-operation in regard to the Public Utilities Street Works Act, 1950, the views expressed by the members show that they have been very aware of inconvenience and of apparent waste of time and money by what seemed to them lack of co-operative planning in the taking up of roads, but once more they appreciated the difficulties involved. The Federation, therefore, stresses the need for closer co-operation between the local authorities and the two industries, particularly in the case of new housing estates where there should be freedom of choice. The need for closer co-operation between all concerned and the importance of educating the general public in the work of the two industries, receives particular mention.

General suggestions include the possibility of one standing charge for the two industries, notice of the next meter reading (possibly on quarterly accounts) showrooms run by manufacturers of gas appliances (that should raise some eyebrows!), a pilot scheme on a significant scale on joint meter reading, etc., and the possibility of advertising leaflets being circulated with accounts.

For a body which is sometimes curtly dismissed as a waste of time, that appears to us to be a pretty good job of work. The views expressed come not from the industry but from the public, yet they have behind them a sympathetic bias towards the industry. We feel that this is a very helpful influence to have around, and moreover, that it clearly indicates the kind of rôle which the Federation can play in the industry's affairs.

## *Multimatic Wall*

COOKING laundering, refrigeration, house heating and water heating in one compact unit—that's the new gas Multimatic Wall, described fully in the August issue of *Gas Service*.

Made entirely of steel in colour-coordinated baked enamel finish, the Multimatic Wall is 10 ft. wide 7 ft. 11 in. high and 33 in. deep. On the left is a built-in waist-high oven, beneath which is a counter top broiler and three storage drawers. On the extreme right is a large refrigerator with a deep freeze compartment. Between the oven and refrigerator is a five-foot stainless steel counter which has a washer-dryer and water heater below. Along the top of the counter are five fold-away surface burners which pivot down for cooking. Running across the entire top of the unit, behind a series of storage cabinets, is a horizontal heating system. The furnace is readily adaptable to gas air conditioning. Inexpensive installation is made possible by the incorporation in the unit of most of the plumbing and all of the flue requirements. An outside terminal, which can be located on the rear or at either end of the Multimatic Wall, exhausts all products of combustion to the outside and makes construction of a chimney and one interior wall unnecessary.

# Personal

MR. A. E. CROOK, C.B.E., has been appointed Chief Engineer (Production) by the National Coal Board. The Board's engineering services at headquarters have recently been reorganised under MR. B. L. METCALF (as Director of Engineering) to whom Mr. Crook will be responsible for mechanical engineering, electrical engineering, inspection, planned maintenance and standardisation. Mr. Crook was H.M. Principal Inspector of Mechanical Engineering in Mines until he took up his new appointment on August 1.

MR. T. S. LING and MR. A. C. BUREAU, members of the staff of the Balfour Group have been appointed to the Board of Directors of Ernest Scott & Co., Ltd., and George Scott and Son (London), Ltd. Mr. Bureau is also Director and General Manager of Bafour Lecocq, Ltd., and Gas Consultant to Henry Balfour & Co., Ltd. Mr. Ling is in charge of the Rietz Division of George Scott & Son (London), Ltd.

MR. P. S. BEALE has been appointed a Director of the British Oxygen Co., Ltd. Mr. Beale was formerly Chief Cashier, Bank of England, and recently General Manager of the Industrial Credit and Investment Corporation of India Ltd., Bombay. MR. R. J. BARRITT has been appointed Chief Executive, Engineering Division, by the British Oxygen Company with effect September 1, 1958.

## *Wages of Gas Workers*

A statement issued by the employers' side of the National Joint Industrial Council for the Gas Industry last week said: 'At a meeting of the National Joint Industrial Council for the Gas Industry held today, further consideration was given to an application from the workers' side for a general wages increase. The employers' side made an offer of 1½d. an hour increase which the workers' side did not accept.'

## Change of Name

ALAR, Ltd., which, in the past, has supplied technical literature and advice on aluminium alloys and castings, has formed a combined organisation with the Federation of Light Metal Smelters. The name of the new body is the Association of Light Alloy Refiners and Smelters; it has 14 member companies.

## Survey of Training

Apprenticeship training in the instrument and control industry was recently the subject of a survey by Mr. W. Stainsby, Education Officer of Electroflo Meters Co., Ltd., a member of Elliott-Automation, Ltd., and Chairman of the E.I.M.C.A.M. Education sub-Committee.

*Watson House training centre of the North Thames Gas Board recently held its annual 'open day' when parents were able to see their boys at work and play. They also met Mr. H. W. Moys, the Board's Staff Controller, Mr. R. N. Le Fevre, Training and Education Officer at Watson House, and heads of technical institutes attended by the apprentices for special education. Pictured above, apprentice Ernie Dunham is watched by his parents (centre) and Mr. C. Marshall, instructor in basic engineering, as he operates a drill.*

# Gas Sales Up In 1st Quarter of Year

## *BUT OVERALL CONSUMPTION STAYS STATIC*

GAS sales increased considerably during the quarter January to March, 1958, when temperatures were lower than average. Over the 12 months April, 1957, to March, 1958, total sales were approximately the same as in the previous year.

In January to March, 1958, temperatures averaged approximately 5°F. below those of the corresponding period of 1957 and gas available was 7% higher in this quarter. Industrial sales of gas for the 12 months ended March, 1958, were about 5% higher than in 1956-57, but domestic sales fell by 2%, while commercial and other sales were unchanged. The average price of gas per therm was 20.2d. for the year.

In the year ended March, 1958, 5% less coal gas was made and the amount of coal carbonised was over 1¼ mill. tons less. The water gas made was higher by 39%, with an increase of 300,000 tons in coke used. Oil gas increased from 5 mill. therms in 1956-57 to 16 mill. therms in 1957-58.

Surplus gas purchased from oil refineries and coke ovens increased by 6% and the total gas available by 2%.

Coke production was 7% lower than in the previous year. Sales were 6% lower, but stocks at the end of the year were higher by ½ mill. tons. Crude tar production fell by 3% and benzole production by 5%.

The recovery in sales of cookers was maintained in the fourth quarter showing an increase of 3% on the full year. Gas space heater sales, however, fell by 5% and water heater sales by 4%. Sales of wash boilers and washing machines increased by 1%, and sales of refrigerators rose from 12,000 to 22,000, an increase of 78%.

In the fourth quarter of the year 1957-58, new gas-making plant of 29.5 mill. cu.ft. daily capacity was brought into use, making the total for the year 115.5 mill. cu.ft. This compares with 105.2 mill. cu.ft. capacity brought into use in 1956-57.

The total mileage of new mains laid in 1957-58 was 1,937 miles, 6% lower than the total for 1956-57.

The total number of employees in the gas industry at the end of March, 1958, was 2% lower than the previous year.

*Dr. J. L. Mayer, Medical Officer at Beckton, right, talks to members of the W.H.O. when they visited the products works recently.*

# *Will Middle East Events Hit Isle of Grain?*

## Article in *The Times* Discusses S.E.G.B. Project

IN an article devoted to the South Eastern Gas Board's Isle of Grain project, *The Times* questions whether recent Middle East events may result in the oil on which it depends proving to be 'scarcer and dearer than was at first expected.' The article continues, however, by expressing the view that the new project, to make more gas from oil, 'marks an important step in the evolution of the pattern of production in the gas industry.'

After briefly reviewing the history of the Isle of Grain plant, *The Times* adds that it is of 'considerable interest, not least because of the high degree of automatic control of the processes, whose operating results and efficiency will be calculated by means of an Elliott "read-out" computer every hour.'

The article continues: 'The whole operation will be controlled by three men in the central control room, and the total number of people employed will be small—one-tenth of the number usually needed for the same output of gas. This is of course partly because the raw material—oil—coming through a pipeline, from the adjacent B.P. refinery, has none of the handling and dirt problems associated with coal.

'An estimate on the safe side puts the cost of gas by the new plant at below 10d. a therm—about two-fifths of the cost of a therm of heat made in a thermal electric generating station. Of this total cost the capital cost is about one-fifth.

'The significance needs no underlining. The plant is much less extensive than normal gas retort plants or coke oven plant, and the capital cost much lower; and the production is exclusively gas, not gas plus coke.

'The plan at the Isle of Grain is to produce a quarter of all the gas used by the S.E. Gas Board, but that will require a trebling of the capacity of the plant to be completed this year.

### New Process

'A new unit of plant will be put down, the former agreement on the purchase of feed-stock has been extended, and a new process will be used to gasify the oil—a process developed by the Shell Petroleum Company at their research laboratories at Amsterdam.'

After discussing briefly the technical aspects of this and the Segas processes, the article goes on to point out that both can use any grade of oil, and that the contract allows the oil company to sell a grade of oil of their choosing—the one therefore which best suits their refinery programme.

'At present it may well be largely a light, low flash-point oil, the low grade gasoline for which there is a poor market. The oil company will naturally tend to supply the fraction from the refinery for which it is least easy to find a remunerative market.

'The quantity to be taken may be up to 5% of the refinery's output. The Isle of Grain refinery has grown rapidly and recent extensions, which include facilities for making high octane aircraft fuel, have increased capacity to process over 9 mill. tons of crude oil a year.

'When this plant is completed the Gas Board will have a high degree of flexibility in its choice of oil or coal as a basis for its operation. All the plants will be needed for peak loads, but otherwise the use of either coal or oil can be cut back. On present showing it would be coal.

'For the country as a whole a similar flexibility will be developed, especially as a high pressure gas grid is built. The preference for using coal will naturally be greatest near the coal mines. New processes of "complete gasification" are being developed.

'Although the Shell process has not been developed in any sense for coal, it is stated that the techniques used will provide useful experience and pointers for gasification of coal in oxygen and subsequent purification.

'A further significant development in the industry is likely in the autumn as the first experimental cargo of liquid methane may be brought direct from the oilfields. The adaptation of the ship to be used for this purpose is now in an advanced stage in America.

'The other side of these developments on the supply side of the gas industry which should result in better and cheaper gas is the building up of a larger market. A larger market for gas is being rapidly built up in the United States, but it is based on natural gas.

'The gas industry is anxious naturally to attract large loads which will lessen the seasonal variation of demand, and reduce the difference between peak and low demand. That of course is difficult, particularly in domestic use or for space heating. Presumably, variation is least for cooking, and less for water than for room heating.

'Tariffs are beginning to be devised to attract the large consumer: The South Eastern Gas Board now supplies gas at 1s. 3d. a therm (1s. 4d. a therm in the outer price district) to domestic users, who pay a standing charge of 39s. a quarter.

*The third annual vehicle inspection was carried out at the Grangetown works of the Cardiff undertaking of the Wales Gas Board recently. Inspection and judging was done by Mr. F. Mason, Chief Engineer of the Western Welsh Omnibus Co., Ltd., and this picture gives an idea of the thoroughness with which the inspection was carried out. This year's winner was Driver E. Parle, who has won this award for the second year in succession. He received a badge to be attached to his vehicle which he holds for 12 months and a monetary award of £10 10s.*

# The Training of Apprentices in Fabrication of Steelwork for the Gas Industry

By B. MORTON, M.A.
*Training Officer, Newton Chambers & Co., Ltd.*

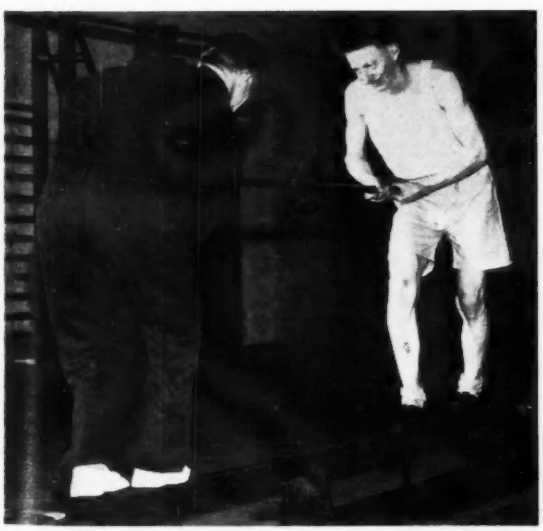
VISITORS to a large, up-to-date gasworks plant, with its tower purifiers, coke ovens and gas holders, must be impressed by its many processes; but seldom, if ever, do they pause to think of the skilled craftsmanship necessary to build such a plant or of the years of apprentice training undergone by the craftsmen concerned.

After the war, apprentice template makers, platers, welders, and blacksmiths—fabrication of steelwork apprentices they are sometimes called—employed in building plant for the gas industry all over the country compared unfavourably with boys in other engineering trades in that there existed no agreed training syllabus between employer and trades unions for these crafts. This position still obtains.

## Need Seen in 1945

As many readers will be aware, Newton, Chambers & Company, Ltd., of Thorncliffe, near Sheffield, having one of the largest and most up-to-date constructional shops in the British Isles, in which Class I welding is undertaken, are the makers of 300-ton steel casting ladles, chemical works plant, and some of the largest spiral-guided gasholders in the country. As early as 1945 this Company realised that the constructional engineering group of trades should have at least as good a syllabus of training as those already in existence for mechanical engineering and foundry apprentices.

Today a training centre, opened by Sir Walter Monckton (as he then was), Minister of Labour in 1952, stands on its own ground on the north-west side of the Thorncliffe Valley, overlooking the works. Equipped with workshops, class-rooms, library and gymnasium and manned by a full time Training Officer and staff of qualified instructors, it is the result of years of careful thought, seeking the best way to attract, select, and train these boys in constructional engineering practice.



*Physical training with a purpose—twisting the pole. Like many of the other exercises, this teaches the apprentice to balance at a height in preparation for work on a gas holder.*

Nothing will compensate a boy of 15, whose father and grandfather were, let us say, template makers or platers, for the disappointment he feels if he is apprenticed to a craft not of his own choosing. And yet in the constructional engineering field there is still much haphazard selection.

At Newton Chambers, after many experiments, it is now felt that the surest way is to select by means of intelligence and aptitude tests, supplemented by an interview conducted by persons fully trained in the administration and interpretation of the tests. This is the first sifting point, and experience has shown that much depends on the correctness of the choices made at this stage. In appreciation of the efforts of all boys who desire to become apprentices, each one is interviewed however unlikely it might seem from his test results that he would gain a place.

Boys entering the service of Newton Chambers—and not less those who have chosen constructional engineering as their career—on their first day have their attention drawn by the Managing Director, who welcomes all newcomers, to three words inscribed on the wall of the training centre: Trustworthy; Helpful; Efficient. They are the watchwords of the good citizen and craftsman. All potential Thorncliffe apprentices are encouraged from their first day of service to take these words to heart and to act upon them all their lives.

As boys wishing to be constructional engineers are not accepted as apprentices until after their 16th birthday, under-16 training is a most important period for them. It is during this time that they are required to give a proof of their trustworthiness, helpfulness, and efficiency, before a decision is made as to their suitability for apprenticeship.

The pre-apprenticeship term of training is divided into the following three periods:

| | | |
|---|---|---|
| Period I | —Induction Training | —1 month |
| Period II | —Vocational Craft Training Including Mathematics, English, Current Affairs and Safety. | —3 months |
| Period III | —Pre-apprenticeship Shop Training | —From the time of completing craft training and entering the shop until the 16th birthday. |

The prime purpose of the Induction Course is to accustom new boys to life in industry by explaining all the main aspects of working life to them, pointing out at the same time important and vital differences from

*An exercise in the second stage, also designed to teach the apprentice to balance at a height in preparation for work on a gas holder.*

the school life they have left behind. To help in this boys are told something of:—

1. The history of the Company.
2. What the Company makes and where it sells its products.
3. The importance of accuracy and sound work.
4. The opportunities offered for education and advancement.
5. Safety rules and accident prevention.
6. Domestic arrangements, welfare facilities, conditions of service, arrangements for holidays, wages, arrangements in case of illness, canteen services.

With this programme as the general background, the boys are introduced to engineering as a career with a short training period in the foundry and machine shop centres. They are encouraged by the training staff to look upon the Induction Course as an exciting adventure, rather like an obstacle race. The finishing point is the last day of the course, when prizes are awarded for the best team performance during the month, to the best all-round boy, and to the most improved boy as compared with his entrance test and interview rating.

### Team Training

Team training, considered so necessary for constructional engineering, is one of the most important aspects of the course. Teams consist of four or five boys who take it in turn to be leader. Leaders are responsible for their team in all matters, particularly that of passing on instructions accurately and of seeing that they are obeyed.

The induction course, as the second sifting point, is conducted at a very fast pace so that, generally speaking, four types of boys quickly begin to emerge:—

1. Boys who are capable, hardworking, self-reliant and dependable.
2. Slow, hardworking, plodding type of boys who are also self-reliant and dependable.
3. Quick witted but unstable type of boys, the quality of whose performance is uneven and who usually cannot be relied upon to work without supervision.
4. Boys who, despite the indications of the tests and interviews, are incapable of making the grade. These are few.

Working hours during the course are exactly similar to those in the shops, and in startling contrast to those at school. Besides general craft training there are some 30 talks supplemented by visits to the workshops, and industrial physical training.

As it is now known that neatness and accuracy in writing up lecture notes is a clear indication of future craft skill, careful training is given in note-taking and in the compilation of a note-book, for which time is allowed at mid-day; but in order to accustom boys to studying at night, the bulk of this work has to be done at home.

Note-books are marked weekly, and any individuals unable to complete their notes in time are penalised heavily by loss of marks for being incapable or unwilling to keep up the right momentum of work.

Meeting so many speakers and having to make intelligible notes from what they say gives the boys their first opportunity of analysing the difference between their former school teachers and the lecturers, in preparation for the years ahead at the technical college.

An example is given below of a typical working day on the induction course.

| TIME | ACTIVITY | IN CHARGE |
|---|---|---|
| 7.30 a.m. | General Craft Training | Craft Instructors |
| 10.00 a.m. | Physical Training | Physical Training Instructor |
| 11.00 a.m. | Lecture: The Constructional Shop | Constuctional Shop Manager |
| 12.00 noon | Dinner | |
| 12.50 p.m. | Writing up Notes | Training Officer |
| 2.00 p.m. | Lecture: Outside Erection | Outside Erection Manager |
| 3.00 p.m. | Visit: Constructional Shop | Craft Instructor |
| 4.00 p.m. | General Craft Training | Craft Instructors |
| 5.00 p.m. | Finish of work | |

*Work in the third month of training combines craft training with inventiveness. The model shows a multiple lift gas holder of novel design to throw a constant pressure for which Newton Chambers have applied for provisional patents.*

Before passing on to the second period of under-16 training, each boy has an interview with the Training Officer, when all results are discussed and suggestions made as to how weaknesses can be put right.

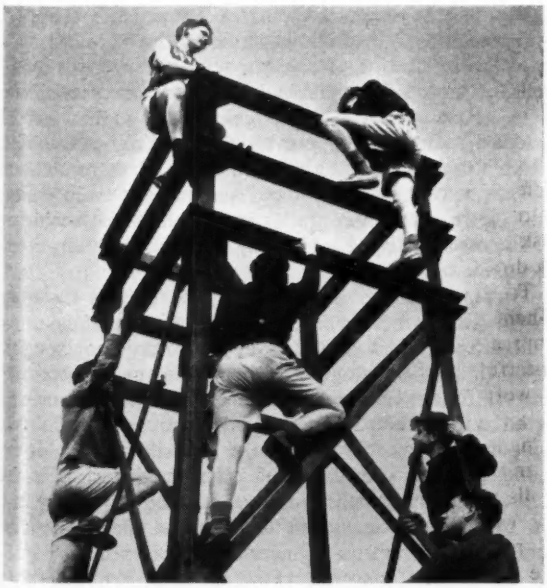
Future prospects in further education are also discussed thoroughly, and no one is left in any doubt as to the extent of the help the Company is prepared to give in this important field. All who wish to qualify in an approved course of study at the technical college are allowed to take day release once a week on full wages after the first year, starting perhaps with City and Guilds in Fabrication of Steelwork, with the possibility of going on to the National Certificate and thence to a Higher Diploma in Mechanical Engineering.

Annual awards up to £5 are made for success in these examinations, to encourage greater effort; but it is emphasised that although the Company is prepared to help in this and in many other ways, the desire and determination to succeed must come from, and be sustained by, the apprentices themselves.

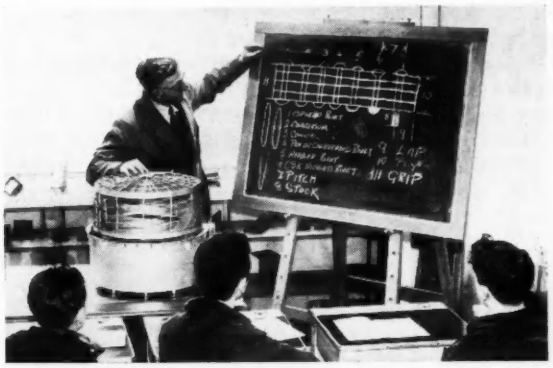
## Vocational Craft Training

The scope of the three months' craft course in the centre parallels the training syllabus of the City and Guilds in Fabrication of Steelwork. Subsequent training in the shops is based on the same syllabus which, in fact, owes much to the training arrangements instituted by the Company in 1943.

Whenever possible the scope of the training given at the centre is widened and deepened by experimental and pioneer work on new products, so that the boys see, and come to understand, how the learning of a craft and revelations of invention can go hand in hand. Every effort is made at the centre to give boys practice in all the trades of the constructional group, so that by the end of the three months, having taken part in fabricating, assembling and erecting some structure, as template makers, platers, welders and blacksmiths, they



*In the third phase, apprentices reach a more advanced stage in learning how to balance at a height off the ground in preparation for work on a gas holder.*



*A lesson in riveting during the second month of craft training, using a sectionalised model gas holder as a visual aid.*

learn to regard this baffling interlocking group of trades as a unity, and begin to develop the breadth of vision necessary for good constructional engineering practice.

In this second period training is also given in safety, by means of films, film strips, lectures and visits to danger spots; in English, by practising the art of writing reports; in mathematics, by giving practice in workshop calculations up to technical college entrance standard; and in current affairs, by explaining simply the mysteries of atomic energy and other current techniques.

Theoretical craft training in its early stages is mainly concerned with an introduction to good welding practice with an explanation, assisted by sketches and diagrams, of the working of electric arc and gas welding equipment. By means of a sectionalised model and diagrams the structure of a weld is studied, particularly regarding defects caused by bad welding practice. The production of steel is also touched upon, leading on to the recognition of material sections, to be followed later by a study of the movement of metal and its reaction to manipulation. On the practical side, simple fabrication is commenced, incorporating marking out and bending. An interesting example of practical work done in this first month is a dustpan, which the boys are allowed to keep.

## Practical Side

Theoretical training is carried a stage further when a study is made of standard material sections, hole centres, back marks, rivets, joints and laps. In practice fabrication work is also carried a stage further, training being given in welding fabrication structures, including also marking out, simple development, together with pressing and bending; fabrication up to this stage is confined to flat plate work as in square tapering hoppers and shutes, however.

There is less theoretical work in the third month, the concentration of training being on the practical application of what has been learnt. Nevertheless, some theoretical work is done on radial line development in the classroom before being put into practice in the fabrication of such structures as lobster back pipe bends, square to round hoppers, and experimental structures such as model gas holders.

Whenever possible special projects are embarked upon, sometimes of two to three months' duration, such as the miniature foundry cupola about to be commenced

for the new foundry at a neighbouring college of technology.

Upon completion of the second period a full report on the work of everyone is sent to the Training Officer who, after a discussion with each boy on the results of his craft training at the centre, decides which boys are fitted to proceed to the stage next of their training in the constructional shop. This is the third sifting point.

### Shop Training

The first three months of training in the constructional shop is done under the close observation of the management who from now on are mainly responsible for the boys' future training and discipline. It is the shop manager together with the Training Officer who, at the end of this three-monthly term decides, just before the 16th birthday, which boys are suited to become constructional engineering apprentices. This is the fourth and last sifting point, of which it may be said that it is rare for boys not to be accepted for apprenticeship by the shop manager.

Once apprentices, boys may specialise in the trade of their choice—template making, plating, welding, or blacksmithing—and they then begin to move round the shop from one craftsman to another, tackling jobs of greater complexity, until they are 21. However, should an apprentice find that he has after all a greater aptitude for another trade—perhaps welding instead of plating—he may switch at the discretion of the manager; for the whole purpose and meaning of his training up to now has been to make him as adaptable as possible.

When entering the shop apprentices are asked if they would like to be considered when they are 18 for outside erection work as a member of one of the Company's mobile teams erecting large plant in different parts of the British Isles. No boys who have reached 18 who are suitable for this work and who wish to go, are ever held back, as it is considered to be excellent training with good chances of advancement.

Reports initiated by the training department on the progress of apprentices are written at six-monthly intervals up to 18, and thereafter at yearly intervals, by the shop manager; in these reports details are given of the apprentices' work for the period under review. Details of this work are then plotted for each boy on a progress chart at the training centre so that the extent of progress may be seen at a glance and arrangements made to prevent anyone from remaining too long on one process.

Shop management is very conscious of the importance of showing interest in the progress of their apprentices, and awards first, second and third prizes annually, irrespective of trade, to both first year and senior apprentices for good work. The Apprentice Shop Advisory Committee, on which the training centre staff are represented, decided which apprentices merit these awards.

### Physical Training

Nothing is of greater value than industrial physical training for finding out what boys are made of. All boys do one hour's physical training a day during the first and second period of under-16 training. As in the introduction of a formal training syllabus in Fabrication of Steelwork, so also in industrial physical training for constructional apprentices, Newton Chambers are pioneers. For these apprentices there are some 14 different exercises designed to simulate the movements of the craftsman at his work, which when practised in the gymnasium produce the co-ordination of hand, eye and mind, necessary for the perfect reproduction of these movements when performing a job.

*Rounding off the training course with project work. Apprentices assembling a model cupola which they made for a local technical college.*

Physical training also brings to light all kinds of hitherto unsuspected bodily defects not readily recognised at medical examination, such as bad eye-sight, deafness, spinal curvature, flat feet, stiff joints, skin trouble, and the like.

But there is yet another purpose for which it is hoped that these physical training exercises may be found useful, namely, that of detecting a tendency towards accident proneness in individuals, from their reaction to tests. Research into this is going on, and if what is believed to be true, is proven, the training centre will be able to furnish valuable data on accident proneness defects in certain apprentices, and prevent their going into the constructional trades at all (where the accident risk is always high) should they be manifestly unsuited to do so.

To sum up, the aim and purpose of the training scheme is first to attract the right kind of boys for apprenticeship and then to train them into being tough, cheerful, obedient, thorough-going young men, prepared to work for the Company at home, on the shop floor, or in an outside erection team anywhere in the United Kingdom. They must be insatiably curious and have a sound general knowledge of other engineering craft skills. They must believe in, and be ready to act upon, the excellent advice given to them on the induction course, that: The true engineer is not the specialist; but the one who, having the widest range of skills, makes himself into a first-rate craftsman in as many engineering fields as possible, so that he will be more adaptable in times of rapid development and change.

# RECENT DEVELOPMENTS IN CANADA

## *Natural Gas Production is Expected to Exceed 15 Times 1955 Level in Next 20 Years, Writes*

## JOHN GRINDROD

DURING the last few months several milestones have been reached in the development process through which natural gas will, in the not too distant future, become one of the most important sources of energy in Canada. Already, the pattern of gas supply and consumption has changed considerably. According to the Dominion Bureau of Statistics, in 1947, 72,000 mill. cu. ft. of gas were produced, of which 25,900 mill. cu. ft., or 35.6%, was manufactured gas and 46,800 mill. cu. ft., or 64.4%, was natural gas. In 1957 of the 184,900 mill. cu. ft. produced, no less than 168,900 mill. cu. ft., or 91.3%, was represented by natural gas.

It has further been estimated by the Gordon Commission that, over the next 20 years, annual Canadian natural gas production will be at least 15 times that of 1955.

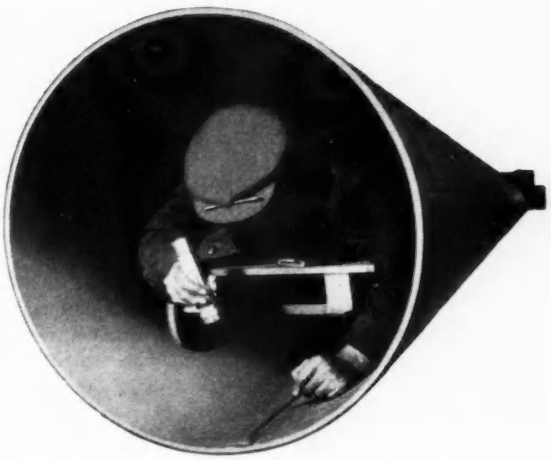
Local gas distribution systems will be both Canadian and U.S. controlled. Those in southern Ontario, Saskatchewan, and on the west coast of British Columbia will remain in Canadian hands, while U.S. interests, often a controlling share, will be found in Alberta, Manitoba, northern Ontario, and Quebec. By 1980, the total capital investment is estimated at $4,800 mill.

### Three Landmarks

Three of the more recent landmarks in this development programme have been the completion of the Westcoast Transmission pipeline from the Peace River area into British Columbia, the completion of the second stage of the Trans-Canada pipeline from Winnipeg to the lakehead ports, and the completion of the pipeline further east from Toronto to Montreal.

Other outstanding features in the Canadian natural gas picture have been the tremendous build-up of domestic market potential in anticipation of its wide distribution, which is causing reconsideration of the supplies available; the possible need for duplicating some of the pipeline facilities, and wisdom of immediate large-scale exports on present terms; the recent Gordon Report on natural gas; and the appointment of a Royal Commission to conduct Canada's first national investigation into overall energy problems, including a priority consideration of those associated with natural gas, its domestic consumption and export.

Intended to serve the entire needs of the Pacific Northwest—B.C. in Canada and Washington and Oregon in America—the 650-mile-long Westcoast Transmission pipeline bringing the Peace River gas to the Sumas area will supply two principal domestic consumers in B.C.—B.C. Electric Company and the Inland Natural Gas Company.



*The internal weld of a tube is seen being examined at the works of the South Durham Steel and Iron Co., Stockton-on-Tees, where some 90,000 tons of pipe for Canada's Westcoast Transmission line were made.*

The former has recently announced that it would use up to 144 million cu. ft. of Peace River gas daily in a giant new thermal power plant to be built in the heavy electric demand area of the Lower Mainland of B.C. and that such gas would be a major fuel used to meet the increasing electricity demand in this rapidly growing region. The Inland Natural Gas Company has a finished inland pipeline system that will supply the Okanagan Valley area and the Trail-Kimberley section.

Since the Peace River gas is both wet and sour it must be processed before being fed into the transmission line and three separate plants have been built at Taylor Flats near Fort St. John. Large quantities of gas are expected to be exported into the North Pacific area of the U.S. by way of the Westcoast Transmission line.

With the completion of the 310-mile, 34-in. Trans-Canada pipeline from the Manitoba-Ontario border to Lakehead, gas is now flowing as far east as Fort William and Port Arthur—a total distance of about 910 miles from the Alberta gas fields. Contracts covering the 367-mile stretch of pipe from Port Arthur to Kapuskasing, Ont., have now been awarded and spread over five sections varying in length. The work is due for completion this year.

### Franchise Privileges

In the north-western Ontario area, the Northern Ontario Natural Gas Company and its associate Twin City Gas Company have franchise privileges to serve some 34 communities and hold a $250 mill., 20-year contract with Trans-Canada. The Company has formed a development department to work with local industries and it is expected that many of the pulp and paper mills in the area as well as the mining companies will take advantage of this new and stable form of energy.

The fact of the presence of an abundance of easily tapped power may also influence the setting up of plants for the processing on the spot of timber and mining products which have been hitherto transported in raw (and bulk) form from the area.

As an example of the type of development that natural gas might make possible is the process recently developed by the Ontario Research Foundation for the production of high grade iron metal from low grade ores at the mine site, for which vast quantities of heat are required. This up-grading of low quality iron may revolutionise Canada's iron mining industry and would open up a tremendous new market for western natural gas.

### Iron Ore Deposits

Between the Manitoba border in Northern Ontario eastwards to Ungava, there are a score of known low-grade iron ore deposits, which contain huge quantities of mineral, but which, so far, have not been worth mining economically.

In the pilot plant, already constructed at the new iron ore laboratories of the Ontario Research Foundation under the direction of Mr. Pat Cavanagh, the low-grade ore has been up-graded by feeding the dry magnetic concentrate into the top of a jet smelter furnace for conversion into 'melting stock' that can be used by such secondary producers as rolling mills for melting down with scrap metal.

Such metal, up-graded from around $13 a ton to $65 a ton would stand transportation costs to America and possibly even to Europe, and its processing could become one of the largest, if not the largest, single market for gas in Canada. Most of the ore bodies are conveniently placed near the Trans-Canada pipeline; others could conveniently obtain oil supplies.

In the 34 municipalities already planned to be served by Northern Ontario Natural Gas and Twin City Gas, some $3 mill. worth of piping and valves are being installed this summer. A total of 2,507,842 ft. of steel pipe of varying sizes has been purchased from Page-Hersey Tubes Ltd., of Toronto. These pipes range in diameter from 12-in. for the 88-mile northern Ontario lateral from Porquis Junction to Sudbury, to ¾ in. for service lines.

### Corrosion Prevention

Some $438,000 will be spent on coating the pipe to prevent corrosion for which special yards have been established. Fisher regulators and relief valves are being used. About $15 mill. in all is being spent on the entire distribution programme by these two companies this summer and this will make natural gas available to over 325,000 people in the company's franchised area, as well as to industries located in northern and northwest Ontario.

Further east, the construction of the 310-mile long 20-in. pipeline from Toronto to Montreal as well as two lateral lines to Lindsey, Ont., and Ottawa, Quebec, has been completed. Until Alberta gas reaches the area, this pipeline will be supplied with south-western Ontario and U.S. gas from Union Gas Company of Canada.

Under this arrangement, which is to operate for one year, Trans-Canada will repay the Union Gas Company in kind with western Canada gas, when the Alberta gas begins to flow. This will make possible an advance build-up of the gas market in the areas served in eastern Ontario.

To make this possible and to provide for its own expanding needs Union Gas Company is constructing a 150-mile 26-in pipeline from its own fields near Chatham, Ont., to link up with the new Toronto-Montreal line.

According to Mr. A. P. Craig, Vice-President Sales, Trans-Canada Pipe Lines, a $1,000 mill. investment will be required to meet the natural gas industry development between 1957 and 1961, including $375 mill. for the Trans-Canada Pipeline; $250 to $300 mill. for developing present proven reserves and processing the gas by stripping such hydrocarbons as propane and butane, $50 mill. for building a trunk-line in Alberta to deliver to the Trans-Canada gate on the Alberta-Saskatchewan border; $200 mill. for enlarging distribution systems in towns and cities; and $200 mill. for industrial expansion already planned, a figure which will probably be later increased.

### Big Increases

Several of the largest distributors have indicated that within a year they will be in the market for 1963 contract volume increases ranging from 40% to 100%; and the construction of a duplicate main transmission line, particularly of the 600 cu.ft. daily capacity line east of Winnipeg, within a few years seems reasonably certain.

Trans-Canada has in fact already re-assumed the rôle of buyer in the Alberta gas fields over and above the 4.35 bill. cu.ft. assigned for export out of the province in an easterly direction. It is expected that the authorised daily peak of 650 mill. cu.ft. will be reached in 1961-62.

Canadian gas exports to the United States have been contemplated to the Pacific North West, to the U.S. Middle West and to Montana. Contracts have already been the subject of negotiation and more recently the Alberta-Southern Gas Company and Westcoast Transmission have both placed applications before the Alberta Oil and Gas Board to export gas out of the province to the United States.

The former proposes to export some 450 mill. cu.ft. of gas daily to California via a $330 mill. 1,300-mile pipeline from south-west Alberta, while the latter wishes to augment its planned gas exports by up to 175 mill. cu.ft. daily through a new 170-mile pipeline from Savanna Creek, south-west Alberta, to connect up with an extensive inland system in the Pacific Northwest.

### Caution Sought

With such enormous increases in demand for western gas, both for domestic and export needs, a policy of caution and the need for a clear picture of the overall gas position has been thought advisable by the Diefenbaker Government. To this end, a Royal Commission on Energy Policy was appointed toward the end of 1957 to study the entire question and Prime Minister Diefenbaker has stated that he will await the recommendations of this Commission before making any major move on gas exports. An interim report is expected this summer.

Some criticism has been forthcoming in respect of the prices upon which the export deals with the United States have been based. In particular, the Westcoast Transmission contract calls for an export price of 22c. per m.c.f., without any escalator clause, for the 20-year period of the contract.

A lack of confidence in the export deals negotiated so far also underlies the Gordon Report on 'Canadian Energy Prospects' which was released at the end of 1957. This report favours the putting to work at home of a growing proportion of the Dominion's supplies of energy, in the belief that to be an effective consumer of energy is far more important in the creation of wealth than just being a supplier.

The report says that Canada's domestic demand for gas will reach 2 bill. cu.ft. per annum by 1980 and on the basis of the then reserves of between 70 and 120 bill. cu.ft., Canadian supplies would be endangered by exporting more than 1 bill. cu.ft. a year.

It also claims that export sales to the U.S. at Emerson, Man., would yield a smaller net-back than sales to Canadian industries in Ontario and Quebec; that gas export proposals are apt to be tipped against Canada and that the price of gas as reflected in new contracts at the field in Canada may approximately double in real terms over the next 25 years.

The Gordon Report is the most comprehensive study yet made of Canada's energy resources and has provided a substantial basis from which the Royal Commission, headed by Mr. Henry Borden, can work.

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*GAS ON THE CONTINENT*

# Testing Oils for Catalytic Gasification Processes

THE primary evaluation of oils for gasification is normally on their C/H ratio and Conradson residue. The first gives an average value with little regard to the chemical compounds contained in the oil, and the second is conducted under conditions so far from reality as to be likewise of little use.

This article describes a series of realistic tests. The principle was to vaporise a definite quantity of the oil and pass it with steam over the heated catalyst. Before measuring the gas, the tar and benzol were removed by activated carbon. The suitability of the oil for gasification was based on the calorific value and volume of gas produced, and relating this to an initial charge of 10,000 Kcal per Kg, a value called the 'reduced gas heat content' was obtained in preference to the misused term 'gasification efficiency.'

## New Apparatus

The tests were first carried out in a steel retort with the oil and water together in a quartz vessel; later the charge was absorbed in a silica gel to prevent premature evaporation of the water. The contact catalyst was Onia (bauxite-nickel) heated to 800°C.

Since these methods were not successful, the following apparatus was developed: The test apparatus was a quartz test tube, as shown in the illustration, in which the constituents were placed as follows: 0.75 g. of water mixed with silica gel; quartz wool; 1.5 g. of the oil being tested, mixed with 6 g. of quartz powder; 28 g. of burnt contact catalyst with a grain size of 1 to 2 mm.; a thermocouple was inserted, and finally a layer of quartz wool.

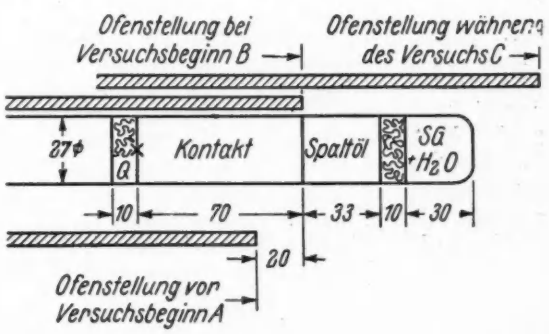
The gas was passed through enough activated carbon to remove only the tar and benzol, as found by a separate experiment, and then to a measuring flask of acidified water. The test tube was placed axially movable inside an alloy-steel muffle with an electric heating coil. The muffle was 29 mm. internal diameter to the test tube's 27 mm. external diameter.

To conduct the experiment, the tube is first placed in position A, the charge being cooled with water, and when the catalyst has reached a constant temperature of 955°C. the tube is moved for five minutes to position B and then to position C, the end being closed with asbestos; 30 seconds later the power is switched off. The volume, calorific value and oxygen content of the gas produced are measured, the latter being used to correct the total volume for the original air.

## Simplicity

The calorific values and gas volumes obtained varied by ratios of 3:2 and 2:1, respectively. The simplicity of the apparatus permits four evaluations to be obtained in a day. The chemical analysis of the gas has been found to agree with those obtained in large-scale plants, and it is the opinion of the authors that the apparatus gives a rapid, useful evaluation of the gasification behaviour of an oil with different catalyst temperatures and oil/steam ratios.

S. Schubert and K. Günther. *Das Gas-und Wasserfach.* Vol 98. No. 49. December 6, 1957. p. 1,224. 4 pp. 2 ff. 1 gg. 5 tt.




Ofenstellung bei Versuchsbeginn A—*position A of test tube in retort;* Ofenstellung bei Versuchsbeginn B—*position B of test tube in retort;* Ofenstellung bei Versuchsbeginn C—*position C of test tube in retort;* Kontakt, *contact catalyst;* Spaltöl, *cracking oil.*

# Chromatographic Gas Analyser-Recorder

By M. VELUT AND J. JOURDA

DURING 1906, the Russian botanist Tswett, studying chlorophyl, succeeded in separating its several elements by passing an ether solution of chlorophyl through a vertical column filled with finely pulverised calcium carbonate. He obtained a series of green or yellow rings close to one another. Adding a pure solvent he observed a second phenomenon; the separation and dispersion of the coloured rings, more or less separated by white spaces.

The adsorption was thus selective, the elements most adsorbed remaining towards the top of the column, those less adsorbed moving towards the bottom at different speeds, thus leading to their separation. From the charge of carbonate of calcium extracted from the column and sectioned into different parts it was possible to isolate the pure products and to determine their nature.

Tswett envisaged the possible extension of this technique to the separation of other substances, even non-coloured, which has since been realised. The term *chromatography* was chosen by him by analogy between the phenomenon he had observed and the dispersal in the spectrum of light decomposed by a prism. This term has been preserved and has passed into general use.

In 1930, the Austrian chemist Kuhn, studying the carotines, used this process and developed its use more and more until today chromatography is considered equal to the two classic methods—crystallisation and fractional distillation.

The apparatus consists of a column filled with an adsorbant which must be judiciously selected. It may be carbonate of calcium, alumina, activated carbon, silica gel, etc. A simple arrangement allows the introduction of the sample and of the elutriant liquid; at the base is an arrangement to collect the elutriated (washed out) products, the examination of the column or of the products collected being then effected by classic chemical methods.

## Methods of Analysis

The methods of analysis in the liquid/solid phase are divided into three:

1. Frontal analysis—in which the adsorbant is soaked in a pure solvent; a solution in the solvent of the product to be analysed then being poured in. At the exit of the column is collected, first a solution of the product least adsorbed, then a mixture of this product with the following, and so on.

2. Analysis by elution (elutriation). This is the original method of Tswett. The adsorbant is soaked, the solution to be analysed is poured in, followed by the pure solvent (this method is difficult with strongly adsorbed products).

3. Analysis by development and displacement designed to overcome the difficulties encountered in the second method. To the solution to be analysed is added a product more strongly adsorbable than the most adsorbable of the products to be analysed; this product is called the ' displacer.'

The development of chromatography by column has been accompanied by that of another technique—chromatography on paper, later known as capillary analysis. From 1850 Rynge utilised strips of filter paper to separate colourants. In 1861 Schonbein developed this process and Goppelsroeder wrote the first treatise on it. Since then, this technique, especially in the hands of bio-chemists, has given remarkable results.

In our industry, certain difficulties in the analysis of gases must lead to the employment of chromatographic methods the simplicity of which does not exclude an astonishing selectivity allied with precision and rapidity. Consider what is included under the term $C_nH_m$ in a classic analysis; and the fact that in recent years our industry has used more and more petroleum products —propane, butane, fuel oils, refinery gas—further complicates the problem.

## Vapour or Gaseous Phase

Chromatographic analysis in the vapour or gaseous phase does not differ essentially from that in the liquid/solid phase. There is always adsorption followed by a selective desorption which constitutes the analysis except that the liquid is replaced by a gas. One utilises either the classic adsorbant column (chromatography gas/solid) or a column containing an inert support soaked in a non-volatile liquid, *i.e.*, chromatography gas/liquid.

These columns, according to requirements, may operate either at room temperature or up to 300°C. or more, with appropriate arrangements, *i.e.*, all the gaseous or vapourisable products in the range of temperature may be amenable to chromatography in the vapour phase. The process is not only qualitative but also quantitative.

Among the phenomena regulating chromatography one may decide the ' time of emergence ' or the ' time of retention,' *i.e.*, the time which separates the introduction of a sample at the top of the column from its emergence at the bottom for a known supply of elutriant gas. In a given time, one measures a determined volume of elutriant gas called the ' volume of retention.'

For a particular column and defined experimental conditions this ' volume of retention ' is a characteristic of each substance, as constant as its fusion and boiling temperatures. In qualitative chromatography this property serves to identify the constituents of a mixture.

Chromatography in the vapour phase has formed the subject of several recent works (among them, D. H. Desty and C. L. A. Harbonn, 'Vapour Phase Chromatography,' 1957, and Courtenay-Phillips, ' Gas Chromatography,' 1956.

Chromatography in the gaseous phase poses delicate problems whose solution has been found in the employment of physical methods. It is necessary to discern in the elutriating gas proportions, often very small, of the constituent elements of a mixture under analysis. The means most utilised is based on the difference in thermal conductivity between the eluant (elutriant) gas and the gas or vapour washed out. In many cases these problems

are solved by mounting thermo-resistances on a Wheatstone bridge and amplifying the current of disequilibrium. There are other methods such as density balance, photo-electric cells, infra-red, ionisation, etc.

But of all the methods cited, two appear to us to be adapted easily to our industry—that of Janak in which the utilisation of pure carbonic acid gas as vector fluid enables, after its absorption by potash, the elutriated elements to be collected selectively by the columns; and that of Scott, which consists in the employment of a combustible vector fluid (*e.g.*, hydrogen) whose temperature of combustion is modified by the presence of the elutriated constituents. The registration of these modifications is effected by a suitably placed thermo-couple.

In the laboratory we have retained the method of Janak because it offers the advantage of using simple and well-known apparatus without costly amplification accessories and because the determination of constituents is reduced to the measurement of gaseous volumes at constant pressure. Its operation at ordinary temperatures for hydrocarbons up to $C_4$ indicates that it would be the method preferred for the gases usually met with at our works.

Availing ourselves of later work, notably that of Ch.Rouit, we set up the necessary apparatus at Marseilles and have put it to the test. Its satisfactory operation showed that this method will meet our needs. At the same time the necessity to balance the pressure and to read a burette of 2 $cm^3$ graduated in hundredths, urged us to render the operation automatic.

At the end of 1956 an automatic apparatus was put to the test and early in 1957 a more robust set-up was constructed and has been constantly in use since then. The first arrangement included an electric recorder the action of which, to be satisfactory, had to be pretty delicate. This was replaced by a very robust mechanical device which has given entire satisfaction and has been adopted in the three existing sets of apparatus.

## The Chromatograph of Gaz de France

The Gaz de France apparatus uses pure carbon dioxide, obtained from solid $CO_2$—placed in two tubes (3) insulated in a Dewar flask to prevent too rapid evaporation. The two tubes are connected respectively to a meter (15) preceded by a dryer with silica-gel and a pressure regulator (10) consisting of a plunger more or less immersed in a mercury seal controlled by the vessel (9) raised or lowered to increase or decrease the flow of $CO_2$.

As the pressure of the $CO_2$ is affected by the level of the 40% potash in the burette a compensating vessel (8) is provided, filled with 40% potash of the same density as the liquid in the burette and fixed to the recorder carriage (12). This arrangement keeps the pressure and therefore the rate of flow of the $CO_2$ constant.

Sampling is done by purge, brought to atmospheric pressure at (2) in the usual manner. Following the tubes containing the sample are the chromatographic columns (1). These consist of glass tubes 4 to 6 mm. diameter by 2 metres long; their operation is controlled by a set of appropriate valves. They are filled, one with activated carbon (CECA acticarbon NCP50) granulation 40-50, the other with alumina gel (gammagel electrogranulation 40-50).

The use of two columns is indispensable if one wishes to operate at ordinary temperatures. The activated carbon thus permits the detailed separation of incondensable gases up to $CH_4$ inclusive (except the separation $O_2/N_2$). The gammagel gives the incondensables with $CH_4$ en bloc but detailed separation of the hydrocarbons, $C_2$, $C_3$ and $C_4$. Filling the column with gammagel over a length of some centimetres with Davidson silica gel gives a clean and excellent separation of ethane and ethylene. Gammagel may be replaced by the activalum S17.

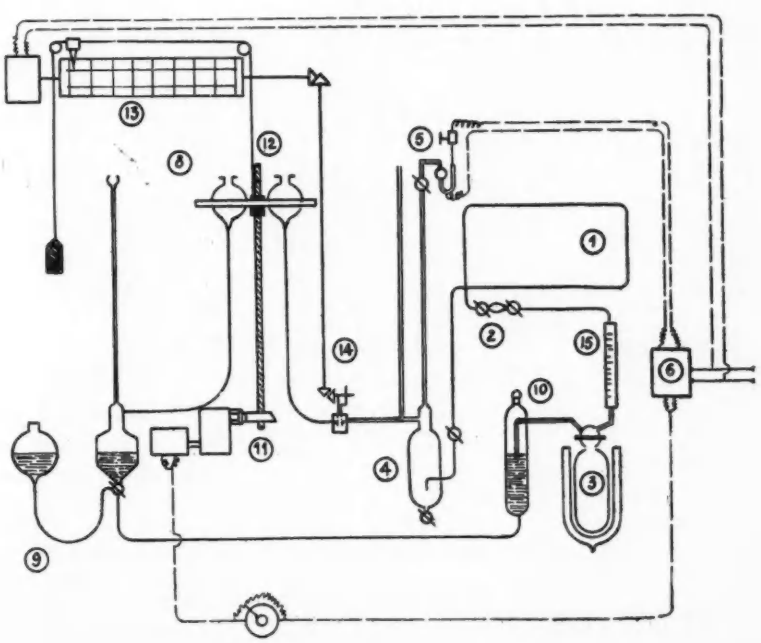



*Fig. 1*

*1. Columns.*
*2. Point of sampling.*
*3. Solid $CO_2$.*
*4. Burette.*
*5. Pressure-contactor.*
*6. Electric relay.*
*8, 9, 10. Pressure balancers.*
*11. Electric motor.*
*12. Recording pen, carriage and screw.*
*13. Recording drum.*
*14. Pulsater.*
*15. Meter; dryer.*

At the exit from the columns the gases are received in the burette (4) filled with 40% potash and connected at its lower end to a pressure balancing vessel by a rubber tube in which is placed the pulsater (14). In the burette $CO_2$ is absorbed, liberating in bubbles the entrained gases which are to be measured.

The upper part of the burette is provided with a 3-way cock leading either to atmosphere to establish equilibrium or to the micromanometer-contactor. The two equilibrating vessels are brought to the zero of the burette by putting the motor (11) into action. The regulation of the screw of the recorder (13) is arranged so that the pen is then brought to zero.

The analysis is shown in the following manner: The columns are first purged with $CO_2$ to eliminate the air they may have adsorbed (in use they are constantly purged by the evaporation of the reserve of solid $CO_2$); the sample is then inserted in the usual manner and sent to the columns—first to the activated-carbon column which separates out the incondensables:—

$$H_2 - (O_2 \text{ plus } N_2) - CO - CH_4$$

The apparatus is then returned to zero and a second sample is sent to the gammagel column which allows to pass rapidly, en bloc, the incondensables and the methane and then supplies, this time in detail, ethane, ethylene, propane, propylene and finally the mixture butanes/butylenes.

The calibration of the apparatus which consists in determining the exact volume of the sample taken is effected with a sample of air sent to the activated-carbon column. The lengths measured horizontally on the drum paper are corrected to the length obtained in calibration taken as unity. Calibration must be done daily or at least for each series of analyses because it varies with temperature.

## Test Results

Various tests were made in 1957 in collaboration with the Research Centre of Gaz de France at Landy. The following tables show the results:

| | Chromatograph Velut-Jourda | Mercury trough at Landy |
|---|---|---|
| Ethylene | 58.3 | 58.7 |
| Propane | 41.7 | 41.2 |

Mixture of pure gases prepared at Landy.

REFINERY GAS No. 1

| | Chromatograph Velut-Jourda | Mercury trough at Landy | |
|---|---|---|---|
| $H_2$ | 13.0 | 12.5 | |
| $N_2$ plus $O_2$ | 9.8 | 9.7 | |
| CO | 1.1 | 1.3 | |
| $CH_4$ | 34.8 | 33.4 | |
| $C_2$ | 33.7 | 32.9 | $C_2H_6$ – 24.5<br>$C_2H_4$ – 8.4 |
| $C_3H_8$ | 1.7 | 2.4 | |
| $C_3H_6$ | 4.6 | 4.3 | |
| $C_4$ | 1.3 | 1.6 | |
| $CO_2$ | not determined | traces | |
| $C_5$ | " " | " | |

This analysis was made before putting into operation the column with mixed gammagel and silica-gel.

REFINERY GAS No. 2

| | Hyd. Robot Podbielnak[1] | Chromatograph Perkin-Elmer | Chromatograph Velut-Jourda |
|---|---|---|---|
| $H_2$ | 23.4 | 23.4 | 23.5 |
| $N_2$ plus $O_2$ | 6.8 | 7.8 | 5.5 |
| CO | 1.4 | | 1.2 |
| $C_1$ | 30.2 | 36.8 | 30.9 |
| $C_2$ | 26.4 | 21.1 | 24.8 |
| $C_2$ | 6.7 | 6.7 | 7.8 |
| $C_3$ | 2.4 | 1.8 | 2.7 |
| $C_3$ | 2.7 | 2.4 | 3.6 |
| $C_4$ | traces | traces | traces |

[1] This apparatus, of American construction, effects automatically a fractionated distillation of the sample previously liquefied at a low temperature.

REFINERY GAS No. 3

| | Hyd. Robot Podbielnak | Chromatograph Velut-Jourda |
|---|---|---|
| $H_2$ | 11.4 | 11.0 |
| $N_2$ plus $O_2$ | 13.3 | 13.5 |
| CO | 0.6 | 0.8 |
| $CH_4$ | 32.8 | 32.2 |
| $C_2$ | 27.7 $C_2$<br>9.6 $C_2$ | 37.9 |
| $C_3$ | traces | 0.4 |
| $C_3$ | 1.0 | 1.0 |
| $C_4$ | 3.6 | 3.5 |

(Analysis made before putting into operation the column with mixed gammagel and silica gel.)

These results, which are quite comparable with other series not shown here and which were carried out on synthetic mixtures, show that our chromatographic technique compares well with other more delicate or more costly techniques the advantages of which only appear to be useful for the more exact determination of certain constituents present in proportions less than 1%, the determination of which is outside the province of routine analysis.

An apparatus such as the Hyd.Robot-Podbielnak costs about 10 mill. francs (1,174 francs = £1), the chromatograph Perkin-Elmer 1 to 2 mill., and in spite of their price they are not, in the opinion of specialists, well adapted to the particular problem of the analysis of fuel gases. On the other hand, the apparatus we are discussing here can be constructed for not more than 200,000 francs. The satisfactory results obtained with it at Marseilles confirm the view that it responds well to the daily problems presented to our laboratories and that its uses in our industry will expand. At the same time, it is possible that improvements will be made which will extend its use to products of greater molecular weights.

*(The above paper was presented to the Association Technique de l'Industrie du Gaz en France.)*

# BRITISH STANDARD FOR BLACKHEART CASTINGS

THREE grades of blackheart malleable iron castings (B18/6, B20/10 and B22/14) form the subject of British Standard for Blackheart malleable iron castings (B.S. 310, 1958), a well-established British Standard last revised in 1947. The chemical composition of the metal of the castings is considered to be of less importance than the mechanical properties. In consequence, compliance with the requirements of the specified tests is to be regarded as the main criterion of the material's 'suitability for purpose.'

The provision and heat treatment of the test bars are specified, as are tensile test and bend test and hardness requirements; provision is also made for additional tests to be undertaken by arrangement with the manufacturer. Alternative dimensions—based on practice in several other countries—are given. They have been included in order to gain experience with them in the United Kingdom, and to facilitate the exchange of information with other countries.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 4s. (postage extra to non-subscribers).